Jersey, Walton Co., Ga., killing one person, and damaging buildings to the extent of about $500. Severe thunder-storms were reported at Pensacola, Fla., on the 3d; in northwest Louisiana on the 5th; and at Dadeville, Mo., on the 31st. Navigation was reported closed for the season on the Great Lakes at Marquette, Mich., on the 3d; at Duluth, Minn., and Green Bay, Wis., on the 4th; at Milwaukee, Wis., on the 5th; at Sandusky, Ohio, on the 6th; at Buffalo, N. Y., and Alpena, Mich., on the 8th; at Cleveland, Ohio, on the 9th; at Oswego, N. Y., on the 13th; and at Port Huron, Mich., on the 25th. Rivers were reported closed by ice as follows: Androscoggin and Penobscot rivers, Me., on the 1st; upper Hudson river on the 3d; Schuylkill River frozen at Philadelphia on the 3d; Detroit River on the 12th; Connecticut River on the 16th; Monongahela River at Morgantown, W. Va., on the 28th, and at Greensborough, Pa., on the 29th; the Susquehanna River at intervals at Wilkes Barre, Pa. The Mississippi River was frozen over at Red Wing, Minn., on the 2d; Lake Pepin the night of the 2–3d; and the river at Dubuque, Iowa, on the 4th. The Missouri River was closed at Fort Buford, N. Dak., the night of the 3d–4th; and at Fort Yates and Fort Sully, S. Dak., on the 6th. On the 2d water was drawn from the Erie Canal west of Little Falls, N. Y., and on the 18th the Morris Canal, New Jersey, closed for the season. Drought prevailed in parts of Illinois, Missouri, Iowa, Louisiana, Texas, Montana, and Oregon.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean atmospheric pressure for December, 1890, as determined from observations taken daily at 8 a. m. and 8 p. m. (75th meridian time), is shown on chart II by isobars. The departure of the mean pressure for December, 1890, obtained from observations taken twice daily at the hours named, from that determined from hourly observations, varied at the stations named below, as follows:

Station.	Departure.	Station.	Departure.
Duluth, Minn	+.001	Saint Louis, Mo	.000
Detroit, Mich	+.004	Memphis, Tenn	−.001
Buffalo, N. Y	+.005	Cincinnati, Ohio	−.002
Chicago, Ill	+.007	Galveston, Tex	−.002
Philadelphia, Pa	+.007	Denver, Colo	−.003
New Orleans, La	+.008	Fort Assinniboine, Mont	−.006
Eastport, Me	+.009	Salt Lake City, Utah	−.007
New York City	+.010	Santa Fé, N. Mex	−.010
Washington City	+.010	San Francisco, Cal	−.014
Savannah, Ga	+.011	Portland, Oregon	−.016
Boston, Mass	+.015	San Diego, Cal	−.016

The mean pressure was highest within an area which extended from north Nevada over Utah to west Colorado, where it was 30.25, whence it decreased eastward to below 29.80 at Cape Breton Island, Canadian Maritime Province, southeastward to about 30.20 in the east and west Gulf states, southward and southwestward to below 30.10 over the extreme southwest part of the plateau region and on the south Pacific coast, westward to below 30.15 on the middle Pacific coast, and northwestward and northward to below 29.95 on the extreme north Pacific coast and in the British Possessions north of Washington, Idaho, and west Montana.

A comparison of the pressure chart for December with that of the preceding month shows that there was a general increase in the mean pressure in the east and west Gulf states, the Mississippi, Ohio, and Saint Lawrence valleys, the Lake region, over the southern plateau, and on the middle and south Pacific coasts; elsewhere the mean pressure was lower than for November. The greatest increase in mean pressure occurred in the middle Saint Lawrence valley and northeast Ontario, and over extreme south Florida, where it exceeded .10, and the most marked decrease in mean pressure occurred on the extreme north Pacific coast, where it exceeded .20. The area of high pressure which covered the middle and northern plateau regions in November contracted and in December occupied a part of the middle plateau. Over the Canadian Maritime Provinces, where the mean pressure for November was lowest, there was a decrease of about .10.

The mean pressure was above the normal, except in the Atlantic coast states from Georgia northward, over the northern part of the country from Lake Superior westward to the north Pacific coast, and on the extreme south Pacific coast. The greatest departures above the normal pressure occurred from the east part of the middle plateau region southeastward to the west Gulf coast, where they exceeded .05, and the most marked departures below the normal pressure were noted over east Nova Scotia and Cape Breton Island, where they exceeded .10. In the British Possessions north of Minnesota, North Dakota, and Montana the departures below the normal pressure exceeded .05.

The monthly barometric ranges at regular stations of the Signal Service are shown in the table of Signal Service data on the last two pages of the REVIEW.

AREAS OF HIGH PRESSURE.

I.—Appeared in Manitoba on the 1st and moved along the extreme northern limit of the United States, reaching the Gulf of Saint Lawrence on the 3d. The temperature fell 10° to 20° over the Northern States on the 1st, and a further fall of 6° to 10° occurred on the 2d.

II.—First appeared north of Montana on the 2d, moved southeastward to Missouri, eastward to Cape Hatteras, and thence southward to northern Florida. A second rise in pressure, following and combining with the increased pressure accompanying number II, produced a high area whose centre was in the Saint Lawrence Valley on the 5th. The temperature fell 10° to 20° in the Ohio and lower Mississippi valleys on the 3d, and 10° in the middle and south Atlantic states on the 4th.

III.—This high area was central in Montana on the 5th, in the Missouri Valley on the 6th, and north of Lake Ontario on the 7th. The pressure on the 5th increased 0.50 inch in Colorado, and the temperature fell 10° to 18° in that state and Arkansas. The area of increased pressure on the 6th included the upper lake region, the upper Mississippi and Missouri valleys, and the southwest. The temperature fell over the same area, the greatest fall being in northern Texas, where it was 15° to 22° on the 7th. There was a fall of 10° in temperature over the Lake region, New England, and the middle Atlantic states. Following the centre of number III was a second centre of high pressure, which formed a part of the same general wave of high barometer that extended from British America to the Gulf of Mexico. On the 7th it caused a further fall of temperature in Texas and Louisiana, and on the 8th a fall of 20° to 30° in the east Gulf states.

IV.—The centre of this high area is traced from British Northwest Territory to Kansas, and thence eastward to North Carolina. Its motion was then to the northwest and it was in Ohio on the 14th, on the 15th in the Saint Lawrence Valley, and on the 16th over Nova Scotia. A fall of 10° to 20° in temperature preceded the centre of the high, reaching the Atlantic coast on the 12th. The southern position of the high on the 13th and 14th, in connection with low area VIII, caused a rise in temperature in the Atlantic coast states on those days. The subsequent movement of the high caused a decided fall of temperature in New England and the middle Atlantic states on the 15th and 16th, the greatest fall being 30° in Vermont on the 16th.

V.—An area of high barometer appeared on the California coast on the 14th. It moved east and southeast to extreme southern Texas, and thence northeast to Cape Hatteras; at this point it united with a high area that started in Manitoba

on the 18th, passed eastward to the Saint Lawrence Valley, and southward to Hatteras, N. C., reaching that point on the 20th. There were no very decided temperature changes, which were irregular, until the appearance of the high in Manitoba on the 18th brought a fall of 20° to 30°, which the next day extended over New England. The lowest temperature was, however, recorded the next day under the influence of the southern position of the high in conjunction with low area number X then central in the Lake region.

VI.—This area was on the California coast on the 20th, in Kansas on the 21st, and over the east Gulf states on the 22d and 23d. The temperature falls were slight, except in New England, when a rise in pressure of 0.40 inch in the Saint Lawrence Valley was coincident with a fall of 10° to 30° in the Maritime Provinces and New England.

VII.—This area followed the extreme northern limit of the United States from British Northwest Territory to the Saint Lawrence Valley and thence to Nova Scotia. The barometer rose nearly 1.00 inch in Manitoba on the 23d, the increase in pressure extending over the lakes, with northwesterly gales and a fall in temperature of 20° to 30°. Similar conditions prevailed over New England on the 24th. The centre of the high remained over Nova Scotia until the 26th when under the influence of low area number XII violent northeast gales prevailed on the New England coast, with velocities ranging from 40 to 68 miles per hour.

VIII.—This area was central in Utah and resulted from a separation of an extended area into two distinct highs, one moving into Kentucky and the other, with increased pressure, extending over Utah and western Colorado. The path of its centre was over the Indian Territory, and Louisiana to Florida, where it was central on the 29th. Killing frost was reported from Pensacola, Fla., on the 28th and 29th, and from Mobile, Ala., on the 29th, and freezing weather was reported at Jacksonville, Fla., during the night of the 28th.

AREAS OF LOW PRESSURE.

I.—Which is a continuation of low area XII of November, was central over Lake Erie on the morning of the 1st and moved during the day southeastward to Virginia. It was accompanied by light snows in the lower lake region and the middle Atlantic states.

II.—This area was central on the Washington coast on the morning of the 1st. It moved southeastward and reached Arkansas on the night of the 2d, where it united with a depression that had developed in Texas on the 1st. The path of the storm after leaving Arkansas was to the northeast over the Lake region and thence to Nova Scotia. Rain fell in Washington on the 1st, and snow in the upper Mississippi and Missouri valleys on the 2d. The area of snowfall extended from the Lakes to New England on the 3d.

III.—This disturbance first appeared on the coast of Washington on the morning of the 3d. The centre moved southeast to New Mexico and thence eastward over the Gulf States to the South Carolina coast, and then followed the coast line to Nova Scotia. The path of this storm is traced for six days, from the 3d to the 9th. Rain fell on the Pacific coast from Washington to southern California on the 3d, and continued on the south Pacific coast on the 4th. Rain fell in Arizona and New Mexico on the 5th, and continued during the 6th. The subsequent precipitation was as follows: rain in the west Gulf states on the 5th, in the east Gulf states on the 6th and 7th, on the south Atlantic coast on the 7th and 8th, and snow in the middle Atlantic states on the 8th.

IV.—This low area appeared central northeast of Lake Superior on the morning of the 6th, separated from low area III, then central in Arkansas, by a low ridge of high barometer. The centre moved southeastward to New York and thence northeast to Nova Scotia, causing rain or snow in the Lake region, the Saint Lawrence Valley, and New England, with high winds on the north Atlantic coast.

V.—The path of this area was beyond the limits of the United States, and was too far north to have any marked effect on the weather within the limits of the area of observation.

VI.—This area was central in British America north of Montana on the 8th. Its course was southeasterly, passing north of the Lake region to the Saint Lawrence Valley and thence over Nova Scotia. The amount of precipitation reported was small and the areas limited.

VII.—This disturbance appeared as a secondary development following number VI. It was over the Lake region during the night of the 10th and morning of the 11th, and was central near Yarmouth, N. S., on the morning of the 12th. It caused snow and high northwest gales over the lakes and on the New England and middle Atlantic coasts. The study of these two areas (VI and VII) shows the great effect of absolute vapor pressure on the development and movement of storms. It is quite easy to discover in advance of any well-developed storm new centres of development, but number VI is a case in which a decided area of low pressure passed away leaving behind it the conditions necessary for the development of a low with relatively higher pressure but of much greater intensity.

VIII.—Passed from the Pacific coast north of the United States to Lake Superior from the 12th to 14th. It caused rain on the north Pacific coast on the 12th, and high west winds over the lakes on the 13th and 14th.

IX.—This was the most important storm of the month. It was central north of Montana on the morning of the 14th, and moved slowly eastward, and on the night of the 15th was central in Manitoba. At this time the winds had shifted to the northwest in the Missouri Valley, and high northwest winds, with velocities of 30 to 48 miles per hour, prevailed in Montana, Wyoming, North and South Dakota, Nebraska, and Kansas. During the night of the 15th the storm-centre moved to Lake Superior; there was also a secondary development in Illinois, and the area of precipitation extended over the Lake region, the Ohio Valley, and the south Atlantic states. During the 16th the area of low pressure central over the lakes filled up, and the secondary development increased and appeared as the storm-centre on the North Carolina coast; from this point it generally followed the coast line to the northeast. General rain or snow storms prevailed east of the Mississippi River as far south as Georgia on the 16th and 17th, and continued in New England and the middle Atlantic states on the 18th, with high northeast shifting to northwest winds from Cape Hatteras to Nova Scotia.

X.—This low area appeared on the north Pacific coast on the 18th. It moved eastward north of the United States to the Saint Lawrence Valley, and thence to the northeast. It caused light rain in the lower lakes and the Ohio Valley on the 20th, the area of precipitation extending over New England and the middle Atlantic states on the 21st.

XI.—Was central north of Montana on the 21st. In its movement to the eastward it followed closely the path pursued by the preceding storm. There was no appreciable precipitation in advance of the storm. After the centre had reached the Saint Lawrence Valley light snow fell in the Lake region on the 23d, and in New England on the 24th.

XII.—The description of this storm includes the history of two areas, distinct "lows," that moved simultaneously across the United States and finally united in one great storm south of Nova Scotia on the 27th. The a. m. report of the 25th showed two areas of low barometer, one central in Washington and the other in Louisiana. The path of the northern "low" was across the extreme northern part of the United States to the Saint Lawrence Valley, and thence southeastward across New England. The low area central in Texas on the 24th moved eastward to Louisiana and thence over Tennessee to Cape Hatteras; its course was then up the coast until it united with the northern area near Yarmouth, N. S. The rain began in the lower Mississippi valley on the 24th, and continued in the Gulf States on the 25th. Snow fell on this day in the Ohio Valley and Middle States, the snow area extending during the

night and the next day into New England. Heavy gales prevailed on the middle Atlantic and New England coasts, with velocities ranging from 40 to 68 miles per hour. After the two lows united the intensity of the storm increased. The barometer on the morning of the 27th read 29.16 at Yarmouth, N. S. The gales over the lakes and the north Atlantic coast continued until the 28th.

XIII.—The centre of this low area was first located north of Montana. It moved southeastward and was over the Lake region on the 28th, and was accompanied by snow. On the 29th the centre was in the Saint Lawrence Valley and it then passed over Nova Scotia. Snow, with northwest gales, prevailed over the Lake region on the 29th, and on the New England coast on the 28th and 29th.

XIV.—The centre of this low area appeared in Montana on the 29th, was over South Dakota on the 30th, and in Kansas on the 31st. The night map of the last day of the month shows that rain or snow storms prevailed over the entire country east of the Rocky Mountains, and violent northerly gales with snow from North Dakota southward to Kansas.

Tabulated statement showing principal characteristics of areas of high and low pressure.

Barometer.	First observed. Date.	First observed. Lat. N.	First observed. Long. W.	Last observed. Lat. N.	Last observed. Long. W.	Duration.	Velocity per hour.	Maximum pressure change and maximum abnormal temperature change in twelve hours and maximum wind velocity. Station.	Rise.	Date.	Station.	Full.	Date.	Station.	Direction.	Miles per hour.	Date.
High areas.		°	°	°	°	Days.	Miles.		Inch.			°					
I	1	51	100	47	60	2.5	33	Sydney, C. B. I	.60	3	Halifax, N.S	27	1	Nantucket, Mass	nw.	36	2
II	2	51	110	31	80	3.0	40	Portland, Me	.70	4	Nashville, Tenn	27	3	Block Island, R. I	nw.	56	4
III	5	50	113	47	76	2.5	35	Parry Sound, Ont	.48	7	Northfield, Vt	21	8	Nantucket, Mass	nw.	34	7
IV	10	51	115	46	62	6.0	33	Qu'Appelle, N. W. T	.60	10	Rapid City, S. Dak	21	13	Block Island, R. I	nw.	46	12
Va	14	42	124	35	74	6.0	29	White River, Ont	.52	18	Toronto, Ont	22	19	New York City	nw.	44	18
Vb	18	52	97	35	74	2.5	32										
VI	20	40	124	32	84	3.0	35	Qu'Appelle, N. W. T	.50	20	Rockliffe, Ont	29	22	Saugeen, Ont	nw.	38	21
VII	22	54	115	47	58	4.5	26	Swift Current, N. W. T	.74	22	Saint Vincent, Minn	33	22	Grand Haven, Mich	nw.	52	23
VIII	26	38	109	28	84	2.5	28	Saint Vincent, Minn	.76	26	do	35	26	Fort Sully, S. Dak	nw.	56	26
Mean						3.6	32		.61			27				45	
Low areas.									Fall.			Rise.					
I	1	42	82	37	77	0.5	33	Norfolk, Va	.16	1	Chattanooga, Tenn	23	1	Hatteras, N. C	sw.	24	1
II	1	47	124	45	68	3.0	47	Chatham, N. B	1.08	4	Chatham, N. B	41	4	Block Island, R. I	s.	42	3
III	3	48	124	36	74	5.5	32	Red Bluff, Cal	.46	3	Nashville, Tenn	23	5	Red Bluff, Cal	se.	42	3
IV	6	48	85	47	59	1.5	42	Chatham, N. B	.70	7	Halifax, N.S	19	6	Block Island, R. I	e.	38	6
V	7	53	111	49	87	1.0	42	Port Arthur, Ont	.46	8	Marquette, Mich	20	8	Marquette, Mich	sw.	38	8
VI	8	54	110	47	59	3.0	36	Halifax, N.S	.46	11	Kingston, Ont	24	9	Northfield, Vt	s.	30	11
VII	11	43	81	44	63	1.5	28	Boston, Mass	.16	12	Portland, Me	7	12	New York City	nw.	36	12
VIII	12	48	125	49	84	2.5	35	Prince Albert, N. W. T	.86	12	Minnedosa, Man	23	13	Marquette, Mich	w.	30	14
IX	14	53	114	47	58	4.5	38	Sydney, C. B. I	.96	18	Chatham, N. B	13	18	Block Island, R. I	ne.	82	17
X	18	47	124	46	58	4.0	37	Northfield, Vt	.42	21	Northfield, Vt	27	21	do	sw.	34	21
XI	21	51	112	49	61	3.0	35	White River, Ont	.62	22	do	21	26	Marquette, Mich	sw.	36	22
XIIa	24	33	104	48	64	3.0	40										
XIIb	25	48	122	44	66	2.0	56	Yarmouth, N.S	1.18	27	Yarmouth, N. S	27	27	Block Island, R. I	e.	68	26
XIII	27	53	109	43	64	2.0	50	Milwaukee, Wis	.62	28	Milwaukee, Wis	28	23	Chicago, Ill	sw.	48	28
XIV	29	54	102	37	97	2.5	33	Wichita, Kans	.34	31	Concordia, Kans	15	30	Pueblo, Colo	w.	34	30
Mean						2.6	39		.60			21				42	

NORTH ATLANTIC STORMS FOR DECEMBER, 1890 (pressure in inches and millimetres; wind-force by Beaufort scale).

The paths of the depressions that appeared over the north Atlantic Ocean during December, 1890, are shown on chart I. These paths have been determined from international observations by captains of ocean steamships and sailing vessels received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Among the more notable features of the month were the abnormal southerly course of storms over the eastern part of the ocean, the low pressure which prevailed off the coast of southern Europe during the first two decades of the month, and an unusual prevalence of stormy weather, more especially over the western part of the ocean.

Fifteen storms have been traced for December, 1890, the average number traced for December during the last 7 years being 10.3. The greatest number of storms previously traced for December was 13, in 1887 and 1889, and the least number was 7, in 1884. Of the storms traced for the current month 11 advanced from west of the 60th meridian; one apparently originated east of the Azores; 2 first appeared over mid-ocean between the 50th and 60th parallels; and one moved from high latitudes south of east over or north of the British Isles. 4 storms traversed the ocean from coast to coast.

On the 1st a storm which was central November 30th about midway between Bermuda and the south Atlantic coast was located south of Cape Breton Island in latitude about N. 41°, with pressure falling to about 28.00 (711) and gales of hurricane force. By the 2d this storm had passed to northeast of Newfoundland, with an appreciable loss of energy, after which it disappeared north of the region of observation. This was the severest storm of the month. At Saint John's, N. F., the gale of the 1st was reported the heaviest in 40 years, and the barometer fell to 28.31 (719) at 11 p. m. The force of the wind was estimated at 70 to 80 miles per hour. Houses, trees, etc., were blown down, and great destruction was caused to shipping off Newfoundland and Nova Scotia, and in the Gulf of Saint Lawrence. On the 1st a storm of considerable strength was central south of Iceland, whence it apparently moved south of east over or north of Scotland. On the 2d a storm was central west of the Spanish Peninsula, whence it moved slowly northeastward to the Bay of Biscay, where it was central on the 5th and 6th, after which its course cannot be traced with reports at hand. On the morning of the 4th a storm of considerable strength was central in New England, whence it passed northeastward over Newfoundland beyond the region of observation, attended by very severe gales over Nova Scotia and Cape Breton Island. On the morning of the 7th a storm was central over Nova Scotia, whence it moved to the northeast of Newfoundland by the 8th, with heavy gales, and pressure falling to 28.72 (729) at Saint John's, N. F., at 7 a. m. of the 8th. By the 9th the storm-centre had advanced northeastward to the 40th meridian, without an appreciable loss of energy, after which it moved east and south of east and disappeared over the Bay of Biscay after the 11th. During